

Remarks

A. Pending Claims

Claims 2039-2116 and 5150-5155 are pending in the case. Claims 2039, 2048, 2050, 2062, 2072, 2073, 2078, 2087, 2089, 2101, 2111, 2112, 5150, 5152, and 5153 have been amended. Claims 2043 and 2082 have been amended

B. The Claims Are Definite Pursuant to 35 U.S.C. § 112, Second Paragraph

The Examiner rejected claims 5152 and 5153 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant has amended claims 5152 and 5153 to remove the “hydrocarbon containing material” feature objected to by the Examiner.

C. The Claims Are Not Anticipated By Tsai et al. Pursuant To 35 U.S.C. § 102(b)

The Examiner rejected claims 2039, 2041, 2044, 2045, 2049, 2065, 2072-2074, 2078, 2080, 2083, 2088, 2104, and 2111-2113 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,299,285 to Tsai et al. (hereinafter “Tsai”). Applicant respectfully disagrees with these rejections.

The standard for “anticipation” is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 U.S.P.Q. 81, 91 (Fed.Cir. 1986); *In re Donahue*, 766 F.2d 531, 226 U.S.P.Q. 619, 621 (Fed.Cir. 1985).

Amended claim 2039 describes a combination of features including: “providing heat from one or more heaters positioned in heater wells to at least a portion of the formation....” Amended claim 2078 describes a combination of features including: “providing heat from one or

more heaters positioned in heater wells to at least a part of the formation....” Support for amendments to the claims is found in the Specification at least on page 31, lines 14-19. The above quoted features, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Tsai discloses: “the oxidizing gas is injected into the injection hole at an appropriate rate and the fire is started in the coal bed at the injection well.” (Tsai, col.2, lines 30-33) Applicant respectfully submits that Tsai does not appear to teach or suggest providing heat from one or more heaters positioned in heater wells to a part of the formation. Applicant respectfully requests removal of the obviousness rejection of claims 2039, 2078, and the claims dependent thereon.

Applicant submits that many of the claims dependent on claims 2039 and 2078 are separately patentable.

Claims 2041 and 2080 describe a combination of features including: “maintaining a temperature within the part of the formation within a pyrolysis temperature range.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2044 and 2083 describe features including: “wherein at least one of the one or more heaters comprises a flameless distributed combustor.” The Examiner states: “With regards to claim 2044; the Tsai reference teaches a flameless combustor (see col. 2, line 32).” The Examiner further states: “With regards to claim 2083; the Tsai reference teaches a flameless combustor (see col. 2., line 32).”

Applicant’s specification teaches, in reference to flameless combustion:

Flameless combustion may be accomplished by preheating a fuel and combustion air to a temperature above an auto-ignition temperature of the mixture. The fuel and combustion air may be mixed in a heating zone to

combust. In the heating zone of the flameless combustor, a catalytic surface may be provided to lower the auto-ignition temperature of the fuel and air mixture. (Specification, page 4, lines 22-26)

Applicant's specification also teaches:

FIG. 28 illustrates an embodiment of a flameless combustor configured to heat a section of the coal formation. (Specification, page 107, lines 27-28)

Oxidation of fuel fluid 621 may provide heat generation within outer conduit 636. The generated heat may provide heat to at least a portion of a coal formation proximate to the oxidation region of inner conduit 638. Products 625 from oxidation of fuel fluid 621 may be removed through outer conduit 636 outside inner conduit 638. (Specification, page 108, lines 18-21).

Claims 2045 and 2084 describe features including: "wherein at least one of the one or more heaters comprises a natural distributed combustor." The Examiner states: "With regards to claim 2045; the Tsai reference teaches a natural distributed combustor (see col. 2, line 32)." The Examiner further states: "With regards to claim 2084; the Tsai reference teaches a natural distributed combustor (see col. 2, line 32)."

Applicant's specification teaches, in reference to a natural distributed combustor:

As used herein, the phrase "natural distributed combustor" generally refers to a heater that uses an oxidant to oxidize at least a portion of the carbon in the formation to generate heat, and wherein the oxidation takes place in a vicinity proximate to a wellbore. Most of the combustion products produced in the natural distributed combustor are removed through the wellbore.
(Specification, page 31, lines 27-31)

Although the heat from the oxidation is transferred to the formation, oxidation product 519 (and excess oxidation fluid such as air) may be substantially inhibited from flowing through the formation and/or to a production well within formation 516. Instead oxidation product 519 (and excess oxidation fluid) is removed (e.g., through a conduit such as conduit 512) as is described herein. In this manner, heat is transferred to the formation from the oxidation but exposure of the pyrolysis zone with oxidation product

519 and/or oxidation fluid may be substantially inhibited and/or prevented.
(Specification, page 66, lines 17-23)

Tsai does not appear to teach a heater such as a natural distributed combustor or a flameless combustor. Tsai appears to teach starting a fire in the coal bed. Tsai states, “the oxidizing gas is injected into the injection hole at an appropriate rate and the fire is started in the coal bed at the injection well.” (Tsai, col. 2, lines 31-34)

Applicant submits that the combination of the features in claims 2044, 2083, 2045 and 2084 do not appear to be taught or suggested by the cited art.

Claims 2049 and 2088 describe a combination of features including: “wherein allowing the heat to transfer comprises transferring heat substantially by conduction.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2065 and 2104 describe a combination of features including: “controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Amended claims 2072 and 2111 describe a combination of features including: “wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Amended claims 2073 and 2112 describe a combination of features including: “wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.”

Permeabilities recorded in Table I of Tsai do not appear to be substantially uniform. Tsai states: "The initial permeability of the core was 2.0, after two days it was 27.5, after three days it was 77.2 and after four days it was 107 as reported in Table I." (Tsai, col. 7, lines 11-14). In addition, Table I of Tsai discloses a permeability of 107 md for Ex. 6 and a permeability of 148 md for Ex. 7, in which the axis of the core was perpendicular to the bedding plane. Tsai does not appear to teach or suggest at least the above-quoted features of the claims. Applicant submits at least the above-quoted features of claims 2073 and 2112, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2074 and 2113 describe a combination of features including: "controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by Fischer Assay." Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

D. The Claims Are Not Anticipated By Terry Pursuant To 35 U.S.C. § 102(b)

The Examiner rejected claims 5150, 5152, 5153, and 5154 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,093,025 to Terry (hereinafter "Terry"). Applicant respectfully disagrees with these rejections.

Amended claim 5150 describes a combination of features including: "providing heat from one or more heaters positioned in heater wells to the portion to heat the portion so that an average temperature in the portion is above a temperature sufficient to pyrolyze coal in the portion...." Support for amendments to the claim is found in the Specification at least on page 31, lines 14-19. The above quoted feature, in combination with other features of the claim, does not appear to be taught or suggested by the cited art.

Terry discloses: "This production plan calls for an oxidizing environment underground

and injection of oxidizers in such a way as to burn the coal completely in this zone.” (Terry, col. 8, lines 45-48) Terry further discloses: “Ignition material, such as the ceramic balls 10, are positioned in the coal strata and air is injected to set the coal on fire.” (Terry, col. 8, lines 55-57)

Applicant respectfully submits that Terry does not appear to teach or suggest providing heat from one or more heaters positioned in heater wells to a part of the formation. Applicant respectfully requests removal of the obviousness rejection of claim 5150 and the claims dependent thereon.

Applicant submits that many of the claims dependent on claim 5150 are separately patentable.

Amended claim 5152 describes a combination of features including: “wherein providing heat from one or more heaters to the portion comprises providing heat to a portion of the coal identified as having a moisture content that is less than about 15%.” Applicant submits at least the above-quoted features of the claim, in combination with other features of the claim, do not appear to be taught or suggested by the cited art.

Claim 5154 describes a combination of features including: “wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heaters are disposed in the formation for each production well.” Applicant submits at least the above-quoted features of the claim, in combination with other features of the claim, do not appear to be taught or suggested by the cited art.

E. The Claims Are Not Obvious Over Tsai Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2042, 2043, 2050-2062, 2066, 2067, 2081, 2082, 2089-2101, 2105, and 2106 under 35 U.S.C. § 103(a) as being unpatentable over Tsai. Applicant respectfully disagrees with these rejections.

In order to reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 USPQ 173, 177-178 (CCPA 1967). To establish a *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). For at least the reasons cited above, independent claims 2039 and 2078 are not obvious over the cited art. Furthermore, Applicant submits that many of the claims dependent on claims 2039 and 2078 may be separately patentable.

For example, claims 2042 and 2081 describe a combination of features including: “wherein at least one of the one or more heaters comprises an electrical heater.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2043 and 2082 describe a combination of features including: “wherein at least one of the one or more heaters comprises a surface burner.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Amended claims 2050 and 2089 describe a combination of features including: “wherein allowing the heat to transfer to the part of the formation heats the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

F. **The Claims Are Not Obvious Over Tsai In View of Elkins Pursuant To 35 U.S.C. § 103(a)**

The Examiner rejected claims 2046 and 2085 under 35 U.S.C. § 103(a) as being unpatentable over Tsai in view of U.S. Patent No. 2,734,579 to Elkins (hereinafter “Elkins”). Applicant respectfully disagrees with these rejections.

Claims 2046 and 2085 describe a combination of features including: “controlling a pressure and a temperature within at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

G. **The Claims Are Not Obvious Over Tsai In View Of Kasevich et al. Pursuant To 35 U.S.C. § 103(a)**

The Examiner rejected claims 2047, 2048, 2086 and 2087 under 35 U.S.C. § 103(a) as being unpatentable over Tsai in view of U.S. Patent No. 4,457,365 to Kasevich et al. (hereinafter “Kasevich”). Applicant respectfully disagrees with these rejections.

Claims 2047 and 2086 describe a combination of features including: “controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day during pyrolysis.”

Amended claims 2048 and 2087 describe a combination of features including: “wherein heating energy/day (P_{wr}) provided to the volume is equal to or less than $h * V * C_v * \rho_B$; wherein ρ_B is an average formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.”

Kasevich states: “this invention provides for heating kerogen in oil shale with electric

fields having frequency components in the range between 100 kilohertz and 100 megahertz where dry oil shale is selectively heated, with kerogen-rich regions absorbing energy from said fields at substantially higher rates than kerogen-lean regions.” (Kasevich, col. 2, lines 9-15)

Tsai states: “This invention relates to the in situ combustion and gasification of a swelling bituminous coal by the injection of air for combustion into the coal bed from one or more injection holes and the production of a combustible gas from one or more production holes.” (Tsai, col. 1, lines 6-10)

Obviousness can only be established by “showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teaching of the references.” *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Applicant respectfully submits that the features of the electric field heating method of Kasevich for an oil shale formation would not be suitable for modifying the in situ combustion process of Tsai for a coal formation to produce the features described in claims 2047, 2048, 2086, and 2087.

H. The Claims Are Not Obvious Over Tsai In View of Stoddard et al. Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2063, 2064, 2102 and 2103 under 35 U.S.C. § 103(a) as being unpatentable over Tsai in view of U.S. Patent No. 4,463,807 to Stoddard et al. (hereinafter “Stoddard”). Applicant respectfully disagrees with these rejections.

Claims 2063 and 2102 describe a combination of features including: “wherein the produced mixture comprises ammonia, and wherein greater than about 0.05% by weight of the produced mixture is ammonia.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2064 and 2103 describe a combination of features including: “wherein the produced mixture comprises ammonia and wherein the ammonia is used produce fertilizer.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

I. The Claims Are Not Obvious Over Tsai In View of Gregoli et al. Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2068-2071 and 2107-2110 under 35 U.S.C. § 103(a) as being unpatentable over Tsai in view of U.S. Patent No. 6,016,867 to Gregoli et al. (hereinafter “Gregoli”). Applicant respectfully disagrees with these rejections.

Claims 2068 and 2107 describe a combination of features including: “altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2069 and 2108 describe a combination of features including: “recirculating a portion of hydrogen from the mixture into the formation.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2070 and 2109 describe a combination of features including: “providing hydrogen (H_2) to the heated part of the formation to hydrogenate hydrocarbons within the part of the formation; and heating a portion of the part of the formation with heat from hydrogenation.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2071 and 2110 describe a combination of features including: “producing

hydrogen and condensable hydrocarbons from the formation; and hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.”

Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

J. The Claims Are Not Obvious Over Tsai In View of Van Meurs et al. Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2040, 2075, 2076, 2079, 2114, and 2115 under 35 U.S.C. § 103(a) as being unpatentable over Tsai in view of U.S. Patent No. 4,886,118 to Van Meurs et al. (hereinafter “Van Meurs”). Applicant respectfully disagrees with these rejections.

Claims 2040 and 2079 describe a combination of features including: “wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons within the part of the formation.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2075 and 2114 describe a combination of features including: “wherein at least about 7 heaters are disposed in the formation for each production well.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2076 and 2115 describe a combination of features including, “further comprising providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

K. The Claims Are Not Obvious Over Tsai In View of Van Meurs And In Further View of Salomonsson Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2077 and 2116 under 35 U.S.C. § 103(a) as being unpatentable over Tsai in view of Van Meurs and in further view of U.S. Patent No. 2,914,309 to Salomonsson (hereinafter “Salomonsson”). Applicant respectfully disagrees with these rejections.

Claims 2077 and 2116 describe a combination of features including: “further comprising providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.” Applicant submits at least the above-quoted features of the claims, in combination with other features of the claims, do not appear to be taught or suggested by the cited art.

L. The Claim Is Not Obvious Over Terry In View of Elkins Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claim 5151 under 35 U.S.C. § 103(a) as being unpatentable over Terry in view of Elkins. Applicant respectfully disagrees with this rejection.

For at least the reasons cited above, independent claim 5150 is not obvious over the cited art. Furthermore, Applicant submits that many of the claims dependent on claim 5150 may be separately patentable.

Claim 5151 describes a combination of features including: “controlling a pressure and temperature within at least a majority of the portion, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.” Applicant

submits at least the above-quoted features of the claim, in combination with other features of the claim, do not appear to be taught or suggested by the cited art.

M. The Claim Is Not Obvious Over Terry In View of Kasevich Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claim 5155 under 35 U.S.C. § 103(a) as being unpatentable over Terry in view of Kasevich. Applicant respectfully disagrees with this rejection.

Claim 5155 describes a combination of features including: “wherein heating energy/day (*Pwr*) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is an average formation bulk density, and wherein an average heating rate (*h*) of the selected volume is about 10 °C/day.” Applicant submits at least the above-quoted features of the claim, in combination with other features of the claim, do not appear to be taught or suggested by the cited art.

Terry discloses: “A method of producing combustible gases, synthetic crude oils, coal chemicals and heat from coal in situ utilizes the combined teachings of in situ gasification, liquefaction and pyrolysis.” (Terry, Abstract, lines 1-4)

For at least the reasons cited above in section H of this document, Applicant respectfully submits that the features of the electric field heating method of Kasevich for an oil shale formation would not be suitable for modifying the in situ combustion process of Terry for a coal formation to produce the features described in claim 5155.

N. Summary

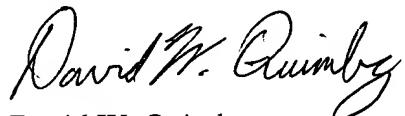
In the Advisory Action mailed February 26, 2003, the Examiner stated: “The proposed amendment also raises issues regarding the various claimed embodiments of heaters; for example, could a “surface” burner be positioned in a heater well?” Applicant believes that a

surface burner can be positioned in a portion of a heater well. In the interest of expediency, though, Applicant has cancelled the claims related to surface burners.

Applicant submits that all claims are in condition for allowance. Favorable consideration is respectfully requested.

A fee authorization is enclosed for the Request for Continued Examination fee. If any extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees are required, please charge those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-05900/EBM.

Respectfully submitted,



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Inventors: Maher et al.
Application No.: 09/841,442
Atty. Dkt. No.: 5659-05900

Marked-Up Version of Amendments Submitted With
Request For Continued Examination

2039. (amended) A method of treating a coal formation in situ, comprising:

providing heat from one or more heaters positioned in heater wells to at least a portion of the formation;

allowing the heat to transfer from the one or more heaters to a part of the formation;

wherein the part of the formation has been selected for heating using a moisture content in the part of the formation, and wherein at least a portion of the part of the formation comprises a moisture content of less than about 15%; and

producing a mixture from the formation.

2048. (amended) The method of claim 2039, wherein providing heat from the one or more heaters to at least the portion of the coal formation comprises:

heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$; wherein ρ_B is an average formation bulk density, and wherein an average heating rate (h) of the selected volume is ~~less than~~ about 10 °C/day.

2050. (amended) The method of claim 2039, wherein allowing the heat to transfer to the part of the formation heats providing heat from the one or more heaters comprises heating the part of the formation such that to increase a thermal conductivity of at least a portion of the part of the formation is to greater than about 0.5 W/(m °C).

2062. (amended) The method of claim 2039, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by

volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

2072. (amended) The method of claim 2039, wherein allowing the heat to transfer ~~comprises increasing~~increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

2073. (amended) The method of claim 2039, wherein allowing the heat to transfer ~~further comprises substantially uniformly increasing~~increases a permeability of at least a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

2078. (amended) A method of treating a coal formation in situ, comprising:
 providing heat from one or more heaters positioned in heater wells to a part of the formation;
 allowing the heat to transfer from the one or more heaters to the part of the formation;
 wherein at least a portion of the part of the formation has an initial moisture content of less than about 15%; and
 producing a mixture from the formation.

2087. (amended) The method of claim 2078, wherein providing heat from the one or more heaters to at least the portion of the coal formation comprises:

 heating a selected volume (V) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and
 wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$; wherein ρ_B is an average formation bulk density, and wherein the heating rate (h) of the selected volume is ~~less than~~ about 10 °C/day.

2089. (amended) The method of claim 2078, wherein allowing the heat to transfer to the part of the formation heats ~~providing heat from the one or more heaters comprises heating the part of the formation such that to increase~~ a thermal conductivity of at least a portion of the part of the formation ~~is to~~ greater than about 0.5 W/(m °C).

2101. (amended) The method of claim 2078, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

2111. (amended) The method of claim 2078, wherein allowing the heat to transfer ~~comprises increasing~~increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

2112. (amended) The method of claim 2078, wherein allowing the heat to transfer ~~further comprises substantially uniformly increasing~~increases a permeability of at least a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

5150. (amended) A method of treating a coal formation in situ, comprising:
evaluating a moisture content of coal in the coal formation to identify a portion of the coal with ~~an-a~~ moisture content that is less than about 20%;
providing heat from one or more heaters positioned in heater wells to the portion to ~~raise temperature in~~heat the portion so that an average temperature in the portion is above a temperature sufficient to pyrolyze coal in the portion; and
producing a mixture from the coal formation.

5152. (amended) The method of 5150, wherein providing heat from one or more heaters to the portion comprises providing heat to a portion of the ~~hydrocarbon~~

containing material~~coal~~ identified as having a moisture content that is less than about 15%.

5153. (amended) The method of 5150, wherein providing heat from one or more heaters to the portion comprises providing heat to a portion of the ~~hydrocarbon~~
containing material~~coal~~ identified as having a moisture content that is less than about 10%.